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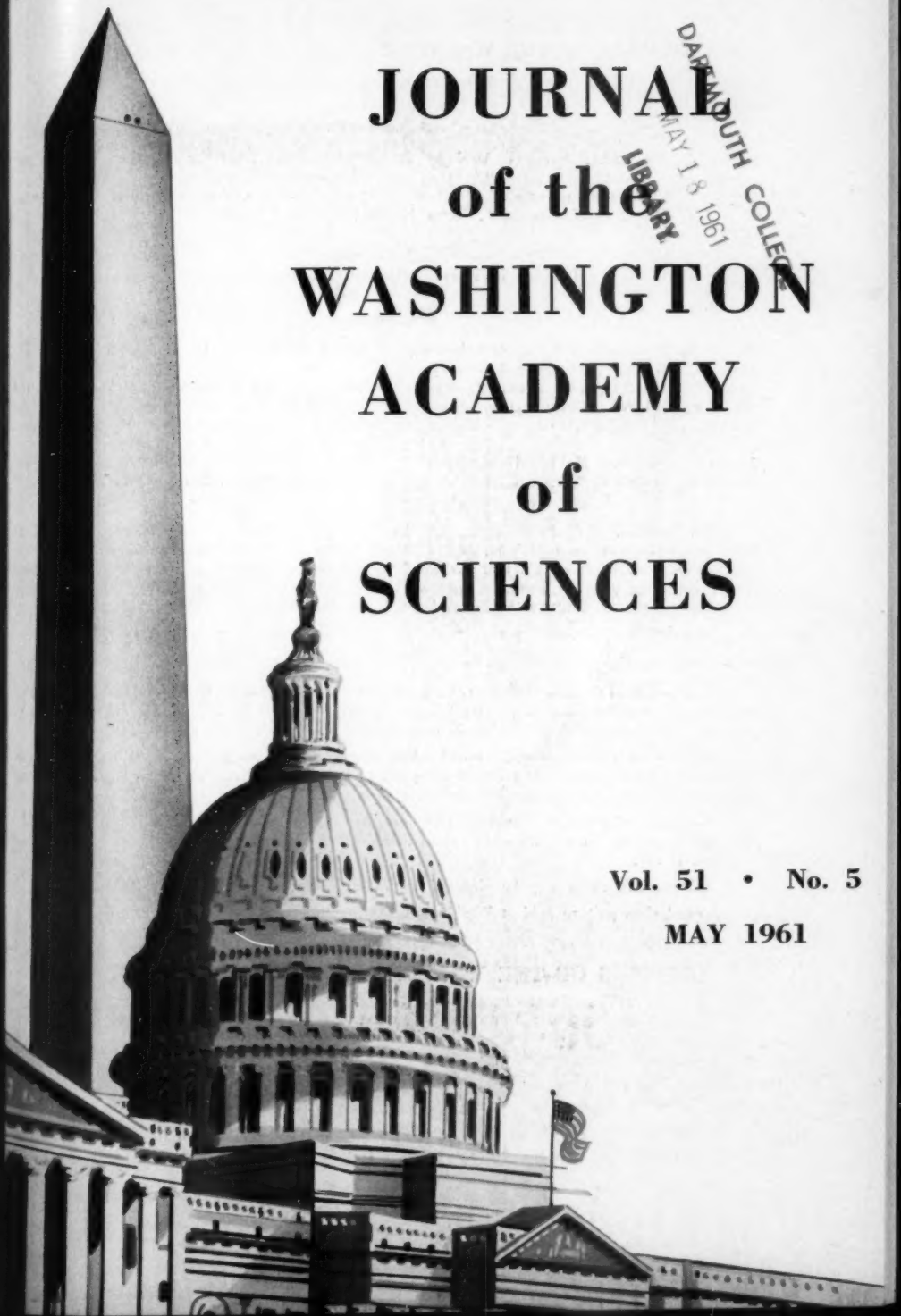

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On the Problems of Mineralogy *

V. M. Goldschmidt

Translated by Gunnar Kullerud

Today [September 28, 1914], as I am about to assume my new position as professor at the University of Oslo, I consider it appropriate to choose for a lecture a topic of a rather comprehensive nature. When one is about to start a new chapter in his life work, he realizes the necessity of looking away from the special investigations of the day and feels the need of a general orientation about the problems that demand a solution and the working tools that we have at our disposal.

We shall attempt to present the status of mineralogical science; and try to shed some light on the existing problems, on the working techniques that are employed, and on the results that so far have been obtained.

The historical evolution of mineralogy has much in common with that of the other natural sciences; mineralogy started as a purely descriptive science.

The different minerals that were found in nature were described in the same manner as plants or animals. It was quite natural at first that attention was primarily directed to the outer features of the minerals, and especially to their regular outer form which is limited by plane, polygonal faces. Almost all minerals form crystals, and it was early noticed that their outer forms are very characteristic for the different mineral species. Therefore, it became possible to draw conclusions concerning the identity of a mineral from its crystal faces.

For this reason it is not fortuitous that the rapid growth of mineralogy as a true science coincided with the time when the shapes of crystals were found to conform to the laws of geometry through the fundamental investigations by Renée Haüy at the end of the 18th century.

The numerous investigations of the geometrical forms of crystals led to the construction of a special type of measuring instrument, the so-called goniometer. These instruments are designed to measure the angles between adjacent crystal faces. They were originally rather primitive and would

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* Published here completely in English for the first time, this is primarily an address of historical interest to earth scientists; secondarily, an account of the early development of mineralogy that should be informative to all scientists unacquainted with the subject. At the suggestion of George T. Faust, U.S. Geological Survey, the address has been translated from Norwegian (*Naturen 38*, 321-334 (1914)) into English by Gunnar Kullerud of the Geophysical Laboratory, Carnegie Institution of Washington.

V. M. Goldschmidt (1888-1947) was noted for his contributions to geochemistry. He was educated in Oslo, took his doctor's degree in 1911, and became a professor in the University and head of its Mineralogical Institute in 1914, an event commemorated by the address here translated. In it he discussed what earth scientists now call the facies principle, having to do with deductions on the distribution of minerals according to the laws of thermodynamics applied to their formation under various conditions of temperature and pressure. His address is frequently cited with reference to this mineralogical phase rule.

Professor Goldschmidt left Oslo for Göttingen in 1929. There he published an important series of papers entitled, "Geochemische Verteilungsgesetze der Elemente." He returned to Oslo in 1935, then was a refugee during World War II, working in Sweden and England. Before he died in 1947 he had been at work on a summation in English of his scientific experience, to be published as a book. This work was completed and edited by Alex Muir. Entitled "Geochemistry," this 730-page book was published in 1954 by the Clarendon Press of Oxford. Of it a reviewer wrote, "This large and handsome volume is a fitting tribute to the memory of Victor Moritz Goldschmidt and his pioneer work in geochemistry."—Ed.

only permit the measurements to be performed with an accuracy of 1 or ½ degree. However, at the present time crystal angles normally are measured with an accuracy of 1 minute, and with the most modern instruments an investigation of even the most complicated crystals can be completed in a rather short time.

Thus, crystallography from the very beginning served to help mineralogy; when a mineral's crystal form once had been measured and described accurately, the limitation of the crystal faces could later be used for the determination of this mineral species.

It would take us too far astray to discuss how crystallography has developed into an independent science, and how it very soon was no longer limited to the study of the outer shape of crystals, but also extended to the problem of the physical conditions that separate crystals from non-crystalline substances.

However, there is one special branch of crystal physics that we ought to stress. This is crystal optics; i.e., the study of the transmission of light through crystalline bodies. Crystal optics is a science that already has obtained its most important results, and for the most important minerals the optical constants are now known with great accuracy.

Optical investigations are of special importance to mineralogy because the optical constants serve as an excellent tool for mineral identification. As soon as we have determined the measurable optical properties quantitatively, such as refractive indices, axial orientations, etc., it is easy to identify minerals from the existing optical determinative tables.

Optical methods of mineral identification have one great advantage over all other methods because they can be applied even when the mineral occurs as microscopic grains.

As an aid to mineralogy and petrography, a special branch of applied crystal optics has been developed. This is the determination of optical constants by means of the polarizing microscope. Based upon the new exact methods, which mostly have been developed by Frederich Becke in Vienna, we can now determine the most important optical constants on mineral grains which are no bigger than 0.01 mm.

In addition to the optical methods there are also a whole series of other physical methods that are used for mineral diagnosis, such as density determination, and many others. It would take us too far from our subject to mention all these methods here. I shall mention in passing only one method that has proven valuable for the determination of numerous Norwegian minerals, and that is the method by which the radioactivity of minerals is quantitatively measured.

Through crystallography and crystal physics, mineralogy is closely bound to the physical sciences, and it is often difficult to decide whether a specific investigation should be considered of a physical or mineralogical nature.

In the meantime, the duties of descriptive mineralogy as a natural science are certainly not completed by the determination of the various physical properties of the minerals. Another area of greatest importance in the field of mineralogy is that concerning the chemical composition of minerals.

During the latter half of the 18th and the beginning of the 19th century, one of the most important tasks for chemists was to analyze minerals, to determine the elements in minerals, and the ratios between the amounts of these elements. In the field of mineral analysis the Swedish scientists have been the foremost leaders, and more than anyone else, Berzelius, who at the beginning of the last century developed analytical methods which in the main still form the basis for the present procedures.

Mineral-chemical studies have also been of great importance to the progress of chemistry. The investigation of the mineral argyrodite is a good example of this. In 1885, a new silver-containing mineral named argyrodite was found in one of the

Freiberg silver mines in Saxony . The well-known chemist Clemens Winkler undertook its analysis and found silver and sulfur to be the main constituents; however, the sum of these elements never totaled more than 93 or 94 percent of the weight of the starting material even after repeated analyses. In this way one was made aware of a new and unknown element, given the name germanium, that amounted to about 6 percent of the new mineral. Many elements were discovered by means of spectroanalytical investigations of minerals; I need only mention indium and gallium.

The accuracy required for mineral analyses is steadily increasing. First, improvements are often made in the analytical methods, mostly because constituents that are subordinate in amount and earlier were often overlooked, are now determined in the analysis. One of the consequences of this is that numerous elements that were previously considered to be very rare, such as vanadium, scandium, zirconium, and others, have proven to be outstandingly common as mineral constituents, even though in rather small amounts. Another point of importance is that the purity of minerals submitted for analysis must be assured. Earlier it was considered sufficient to pick the material by help of the naked eye to obtain a product pure enough for chemical analysis; today automatic methods are used to separate the mineral desired for chemical analysis from all admixed impurities. Among the modern methods devised to obtain pure material for analysis, the method of separation by differences in specific gravities, accomplished through suspension in heavy liquids, should be noted.

The importance of knowing the chemical composition of the individual minerals is apparent from the observation that the entire mineralogical system is based on the chemical composition of the minerals. Thus the two most important areas within the field of descriptive mineralogy are the crystallographic investigations and the determination of the chemical composition of minerals.

If the results of both kinds of investigations are compared, it will be noted that important relations exist between the chemical compositions and the crystallographic forms of the minerals.

As early as 1819 Eilhard Mitscherlich found that substances possessing analogous chemical composition may be similar also in crystal form, a phenomenon which he called isomorphism. As examples of such minerals, we may mention the close crystallographic relations among the minerals barite, celestite, and anglesite, which are sulfuric salts of barium, strontium, and lead. All three crystallize in the orthorhombic crystal system and have nearly the same angular relations.

Such groups of crystallographically isomorphic and chemically analogous substances are very common among the minerals.

If a larger difference in chemistry exists between two crystalline substances, then the differences in crystal forms usually will increase. In some but not all cases, one may directly observe the changes in crystal forms that are caused by definite chemical substitutions. The peculiar group of humite minerals presents one of the most interesting examples of such a situation.

On this occasion I should like to remind you that it was a Norwegian scientist, Th. Hiortdahl, who in 1862 first discovered the laws governing these relations in this field which ties together chemistry and crystallography.

It is the responsibility of descriptive mineralogy to investigate and describe all the minerals that occur in nature. This task can in a general way be said to have been brought to a conclusion. Here and there further special investigations are, of course, required — little-known minerals have to be studied in further detail and old, out-dated investigations must be repeated using new and improved methods; but the study that is still to be accomplished is insignificantly small in compar-

ison with the work that has already been done.

The number of known mineral species at the present time is estimated at 1,000; a number which is not final, however, because new minerals are still to be discovered. In recent years, from six to ten valid mineral species have been discovered each year. Usually they do not yield information of special interest beyond that already learned from numerous older species. One of the few exceptions is the Norwegian mineral, thortveitite, which J. Schetelig described three years ago and which proved to be the first mineral to contain significant amounts of the interesting element scandium.

All in all, the contribution by Scandinavian scientists to the field of descriptive mineralogy must be evaluated very highly. I have tried to express this contribution by compiling statistically the discoveries of new mineral species. It appears that among the 1,000 known mineral species, Norwegian, Swedish, Danish, and Finnish mineralogists discovered more than 150; in other words, more than 15 percent of the total number. At least a score of these were described by Professor Brögger.

The responsibility of mineralogy, however, is not limited to investigations and descriptions of individual minerals. If the entire task amounted only to routine investigation of individual minerals, the job might as well be performed by chemists and physicists.

The distinction of minerals from other inorganic bodies is that minerals originate as products of nature, and for this reason the science dealing with the occurrence of minerals in nature forms a very essential part of the field of mineralogy.

If one wants to study a mineral, then it is not sufficient to investigate a number of museum specimens by means of chemical and physical methods; one must also study the mineral where it occurs in nature, study how it occurs, and observe the geological conditions under which it was formed.

Field observations show the existence of a multitude of different types of mineral occurrences. Some minerals occur only as primary components of igneous rocks; in other words, they must have been formed by solidification of glowing melts. Others are formed by sublimation that accompanies volcanic eruptions; and still others are deposited from thermal waters which have filled fissures in the crust of the earth. Some are formed by evaporation of concentrated salt solutions, others by chemical reactions between older minerals.

If we compiled the observations that exist on the occurrences of minerals in nature and listed them according to geological conditions, we would conclude that minerals can be grouped into a number of associations which embrace the minerals that commonly occur together under certain geological conditions. This concept of mineral association corresponds to the concept of fauna in zoology. Thus, a mineral association is composed of all the minerals which coexist under given physical conditions. I shall mention only a few examples of such mineral associations.

The examples that we here are most apt to cite are the minerals which from the beginning of the last century have made southern Norway a famous locality among mineralogists. I refer to the minerals from the Langesund region not only because it is conveniently nearby, but also because its mineral association is the first which has been exhaustively investigated by modern methods. In a paper of 1890, Brögger gave a prototype for all future investigations of this kind.

Minerals of the Langesund region occur in coarsely grained dikes, so-called pegmatites consisting of nepheline syenite. These pegmatites that accompany larger eruptive masses of nepheline syenite have been found to be especially rich in elements otherwise rare, such as zirconium, thorium, and the rare earths yttrium and cerium, etc. The pegmatites are also rich in gases which were dissolved in the melt,

among which water vapor and combinations of fluorine and boron must have played an important role. As a consequence of the peculiar chemical composition of these pegmatites, a rich multitude of rare minerals have formed. A considerable number have never been found previously in other localities. Some of the Langesund minerals were separately investigated earlier by the methods of descriptive mineralogy; however, Brögger was the first investigator to perceive the importance of treating all the minerals as a group, in which the occurrence of each mineral must be considered in connection with the others.

Closely related mineral occurrences are also found in other localities, especially in Greenland, where nepheline syenites occur with pegmatites.

Another type of mineral occurrence that excels because of its special association is the so-called Alpine mineral fissures that were first studied in the Swiss Alps. These minerals were deposited from aqueous solutions in rock fissures that were formed during the mountain-folding period. These occurrences are characterized by beautifully developed quartz crystals, titanium oxide minerals, alkali feldspars, chlorite, and phosphates. These minerals also are the product of defined geological conditions and occur in all localities where the appropriate geological conditions prevailed. They are characteristic of the Norwegian mountain areas.

Another mineral association that might be mentioned is that found in contact metamorphosed limestones, and we need not go farther than to the area around Grefsen to study these minerals, which occur in all localities where limestones are in contact with younger igneous rocks.

Knowledge of the occurrence of minerals in nature contains a chapter of utmost practical importance: the investigation of the economically valuable minerals and their occurrence; the study of ore deposits. In reality, mining of all types is nothing but applied mineralogy.

The two important branches of mineralogy outlined in this paper have provided a vast empirical knowledge; i.e., the study of the occurrence and properties of minerals. However, from a scientific point of view it is not sufficient to possess only a large amount of observational information; it is embodied in the very spirit of science to demand a logical connection between the individual observations, a tie-in of the various facts by means of established causality laws.

Thermodynamics, the basis for all exact thinking within the field of natural sciences, alone can provide mineralogy with the desired causality laws. It is that branch of science which shows us how the equilibrium relations found in nature are conditioned by the three main theses expressed in the theory of heat. When we apply thermodynamics to mineralogical problems, we must consider mineral formation as a chemical process, the final product of which is represented by the minerals. All chemical reactions lead to a final equilibrium situation according to the law of mass action expressed by Guldberg and Waage.

Thermodynamic considerations have been applied to various mineral-forming processes. The first pioneering work in this field was performed by the Dutchman, Van't Hoff, the famous physical chemist who solved the problem of mineral formations in salt deposits.

In central Germany, especially near the city of Stassfurt, there are enormous deposits of rock salts and of potassium salts which were formed in ancient geological times by evaporation of extensive seas. In these massive deposits all kinds of minerals abound, especially chlorides and sulfates of sodium, potassium, calcium, and magnesium; partly as single salts, partly as complex compounds, partly anhydrous, and partly as hydrates. All these salt minerals occur in many different combinations.

Van't Hoff considered from the thermodynamic point of view the question of the equilibrium conditions which will occur

when a large volume of sea water is exposed to evaporation, and which salts will crystallize and in what order. The result of this investigation shows an excellent agreement between thermodynamic theory and mineralogical experience.[1] The minerals which occur in the central German salt deposits, as well as their mode of occurrence, are in complete agreement with theory. Consequently, we have here an example of a mineral-rich association that has been formed under conditions which we have clarified by means of the laws of thermodynamics.

We have in these deposits an example of minerals being formed by evaporation of the liquid in which they were dissolved, namely water. Another very simple process which leads to mineral formation is solidification of a melt by cooling. This mode of mineral formation is especially common in nature. The process is exemplified in any lava flow which erupts as a melt and later solidifies by cooling. Crystallization of this kind of melt is governed by very simple thermodynamic laws that were applied many years ago to the studies of the formation of alloys. Johann H. L. Vogt applied the laws governing the crystallization of melts to mineral formation during solidification of eruptive rocks. Also in this case, excellent agreement exists between the minerals that should form according to theory and those which were found to form in reality.

These two cases are easy to treat theoretically because we can continuously follow the change in the equilibrium relations during the entire period of time from the beginning of mineral formation until it is completed, both during crystallization of salt solutions and during solidification of melts. However, in most cases we only know the system in its last stage represented by the observed minerals, and we do not know the earlier stages of the reaction.

Thermodynamics may be applied to these problems with very advantageous results because, as I have shown, each mineral occurrence in itself possesses the criteria which permit a decision whether we are faced with an equilibrium condition or not. A relationship exists between the number of coexisting minerals and the number of their chemical components, a relation to which I have given the name "the mineralogical phase rule." Provided equilibrium existed during mineral formations, this numerical relation must be fulfilled quite independently of the processes of mineral formation.

Some years ago I had the opportunity to test the validity of this law on the minerals which are associated with contact metamorphism. It can also explain many regularities in the occurrence of ore minerals, which I have shown by the example of silver-antimonisulfides, and the number of examples demonstrating the conformity to this law could be extended without difficulty. Thus, when we know the mineral paragenesis, and which minerals coexist, and what their compositions are, we can immediately decide whether equilibrium conditions were obtained.

What are the conditions for thermodynamic equilibrium, and why is it that we find some minerals in one occurrence and not in another? The answer is that equilibrium conditions depend upon three independently variable factors. The first of these is represented by the bulk chemical composition of the existing minerals; it tells us which starting material the mineral-forming processes had to work with. The two other factors are the temperature and the pressure under which crystallization took place. These factors depend upon the geological conditions of the mineral occurrence. From one given starting material different minerals may form, depending on the temperature and pressure.

[1]Certain salt compounds which cannot form directly by the natural evaporation of sea water, but which in spite of this sometimes occur in these salt deposits, were formed secondarily by reactions between the primary salt minerals. Also these processes of secondary mineral formation in salt deposits are in complete agreement with the laws of thermodynamics.

In some cases we may from purely thermodynamic reasoning predict the temperature and pressure which must exist in order for certain mineral associations to be formed. One example of this, to which I once called attention, is the formation of calcium-rich silicates at the expense of calcium carbonate. This process can only take place within a certain pressure and temperature range. Thus, we have a method to determine the physical conditions, temperature and pressure, which have existed in the crust of the earth during mineral formation.

It is of course of great interest to be able to determine the physical conditions under which an individual mineral has been formed. It is of much greater importance not to limit such investigations to one single occurrence, but to study thoroughly a sizeable area in order to investigate the temperature-pressure distribution during a certain geological era.

Such an investigation, no doubt the first of its kind, is being performed by myself in the Norwegian mountain areas, from Ryfylke to Trondhjemsfjorden, in order to determine the temperature and pressure conditions in this part of the earth's crust during the formation of the Norwegian Caledonides at the beginning of the Devonian. The procedure of such a systematic investigation is as follows: rock specimens are collected a few kilometers apart and each specimen is studied by optical methods to recognize certain signs indicating the temperature and pressure which existed in the locality in question during the formation of the rock. The sum of all observations gives us a picture of the temperature-pressure distribution during the formation of a mountain chain.

After having investigated several thousand thin sections, I expect to finish these studies in the foreseeable future. Our knowledge of the conditions of mineral formation is partly based upon purely thermodynamic considerations. However, there is also another method which provides us with information concerning the conditions existing during deposition of minerals; this is experimentation.

In the first half of the 19th century, attempts were made by laboratory experimentation to produce synthetic minerals identical to those which had been observed in nature. The experimentation was carried out in such a manner as to simulate the conditions which were assumed to have existed during the formation of the minerals in nature. The best-known result of mineral synthesis during this era is that of the French mineralogist Daubrée, who synthesized the mineral cassiterite, SnO_2. Cassiterite occurs in deposits which are assumed to have formed by volcanic gas exhalations of which particularly halogen species, fluorine- and chlorine-rich gases, are assumed to have played a significant role. Daubrée synthesized cassiterite crystals by letting tin chloride vapor and water vapor react at high temperature, and similar procedures served well for the synthesis of a great number of other minerals commonly associated with cassiterite.

A considerable number of the minerals which occurred in nature were gradually synthesized in the laboratory by many different methods, corresponding approximately to the many possibilities of mineral formation by natural processes. Some minerals were synthesized practically by coincidence, inasmuch as technical processes yielded as byproducts, m i n e r a l s which earlier were known from nature; I only need to remind you of the minerals in metallurgical slags (particularly well known from the investigations by Professor Vogt), which so frequently are identical to those occurring in natural silicate rocks.

Mineral syntheses were sometimes of economic importance as well. I may mention here the synthesis of the two gem stones, ruby and sapphire, which are presently produced synthetically in such amounts that the natural minerals have practically lost their great value.

Scientific investigations in the field of mineral synthesis were previously satisfied

with growing the mineral in question and only recording the conditions of its formation in an approximate way. As the principles of thermodynamics began to be applied in the science of mineralogy, more was expected of the results of mineral synthesis. It was not sufficient any longer only to synthesize a mineral; it was also required to have the most detailed knowledge of the temperature-pressure conditions of the synthesis, as well as of the necessary chemical conditions. In other words, mineral syntheses had to be performed as quantitative precision investigations. Large difficulties blocked the progress of such projects. Precision studies had never been attempted before at such high temperatures, 1000° to 2000° C, where even the temperature scale was suffering from regrettable uncertainties. One specific institution must be given the credit for not only having made such investigations possible, but also for having completed numerous investigations of this kind; this is the Geophysical Labortory of the Carnegie Institution of Washington. The publications of this Laboratory bring us every year descriptions of numerous important mineral syntheses performed by the most exact methods. The accompanying numerous scientific observational data give us the basic background for thermodynamic studies of natural minerals.

Mineral syntheses are likewise of great importance for purely descriptive mineralogy because the pure artificial minerals make it possible for us to determine the physical constants with greater accuracy than is possible with the corresponding natural material. Only one disadvantage is connected with the modern mineral synthesis—it requires exceedingly expensive experimental equipment. For this reason it is not possible at the present time to perform such investigations at the University of Oslo. However, we have in this country abundant material for investigations of all the interesting Norwegian mineral occurrences. Studies of this material will prove very fruitful and will especially augment our understanding of the thermodynamic laws governing mineral formation.

As we have seen, mineralogy differs from most or all other natural sciences because its sphere of interest extends into so many different areas. Crystallography, experimental physics, analytical and synthetic chemistry, thermodynamics, and geology must be counted as the absolutely necessary background for mineralogical investigations. However, all these associated sciences have richly reaped the fruits of their cooperation with mineralogy. Crystal physics has, through mineral investigations, almost reached its goal—exploration of the constitution of the solid state. I shall mention in passing in this connection only the work by Laue and Bragg dealing with the application of X-rays in the field of crystallography.

Chemistry owes its thanks to the analysis of minerals and mineral products for the discovery of most elements. Geology is indebted to mineralogy now that it is becoming an exact natural science; it is the thermodynamic mineralogy which gives us numerical data concerning the temperature-pressure conditions prevailing in the earth's crust during geological processes, and these numbers will surely in the future form the basis for the exact mathematical treatment of the mechanics of geology.

After having attempted to survey the problems of mineralogy, the methods which are employed, and the results that so far have been obtained, one realizes involuntarily the great debt of gratitude he owes the generations of scientists who laid the foundation for our present studies, not least to the scientists here in Scandinavia who furnished an essential part of our mineralogical knowledge. I must be permitted to give special thanks to one particular man who has done such an important part of this work and who is also the educator of all the mineralogists of our time in the Scandinavian countries, the man to whom I myself owe so much for my scientific development—Professor Brögger.

The Amateur and the Academy *

Frank L. Campbell

Mr. President and fellow members of the Academy:

I hope this evening to convince you that we are all amateurs with respect to the Washington Academy of Sciences, that the Academy should be proud of its amateur status, and that membership in the Academy should be thrown open to many more amateurs without limit.

Of course, I must define the word that is so important to my thesis. It is derived from the verb that every Latin student of my generation knew best: *amare*, to love. An amateur is a lover of some kind of human activity that some people are paid to pursue, but which he loves so much that he engages in it without pay. The amateur is always compared with the professional, and because the latter may be just as enthusiastic about his subject as the amateur and may have much more time to spend on it, the professional is likely to be more skillful or more productive than the amateur. Thus the word "amateur" has become slightly tainted in the sense of the adjective "amateurish." But I choose to use "amateur" only in the sports sense: the professional is paid, the amateur is not; their relative proficiency is irrelevant.

Obviously a person can be a professional in one subject and an amateur in others. Most of the members of the Academy were elected because they were successful professionals; thereafter they became amateurs with respect to the activities of the Academy, serving as officers or members of committees, attending meetings, helping young people in various ways, serving on the staff of the *Journal*, etc. Their specialized knowledge and ideas are of little use in the Academy, because they can be fully understood, appreciated, and criticized only by other specialists. There is no provision in the Academy for meetings of specialists for critical discussion of work in progress. Such opportunities should be provided by the more specialized affiliated societies. The Academy, covering all branches of natural science, must of necessity appeal to amateurs, because only amateurs can take an interest in all scientific subjects, from atoms to anthropology, and from agriculture to aeronautics.

After all, what is the principal purpose of the Academy? To advance the frontiers of science? No; that is the function of scientific societies where specialists meet to stimulate one another. Is not the principal purpose of the Academy an educational one? To point out to all amateurs that there are frontiers of science to be explored, and to give them some idea of the joys of exploration and of what has been found and may lie ahead? Certainly the Academy is now acting as if mutual education of adults and encouragement of science talent among students were its chief functions. If this is true, all adults who want to participate ought to be members of the Academy. We should have in the Academy not only older scientists whose work has been "recognized," but younger men and women on their way to recognition, science teachers of all ages, and intelligent people who recognize the importance of science in modern civilization and want to know more about it and its practitioners—people who want to keep up with their children or who have or want a hobby in science.

Is there anything wrong with broaden-

*From the address of the retiring president, February 18, 1960. It consisted of the argumentation here printed, followed by information and commentary on pictures of tree flowers and insect eggs taken by amateurs Walter O'Kane and Alvah Peterson, respectively.—Ed.

ing the base of the Academy? It might be feared that an undiscriminating academy would no longer attract mature professionals who are willing to pay for the satisfaction of belonging to a somewhat exclusive organization. Some organizations maintain class and mass by setting up two categories of membership. Thus the present selected members of the Academy might become Fellows, and anyone upon application might become an ordinary member, subject to advancement to Fellow when qualified. I am not convinced that this system would be better for the Academy than a single category of membership open to all upon application and payment of dues. One can be sure that no selection committee can be completely omniscient and unbiased. My inclination, therefore, is simply to open the doors of the Academy to all who will pay dues, and let recognition come naturally to those who have earned it through their work, both as professionals or amateurs outside the Academy and as amateurs inside.

In one way or another the Academy should greatly increase its membership, not only to bring its income up to its expenses, but to carry out more effectively its major purpose in the community. Other state and municipal academies do not restrict their membership; but on the other hand few, if any, have numerous affiliated societies like those connected with the Washington Academy. It may be argued that the Washington Academy would be competing with its affiliated societies if it were to solicit members in the Washington area. I think it very unlikely that a person eligible for both would choose the Academy instead of an affiliated society nearest to his interests. However, there should be many not interested in any affiliated society who might be attracted to the Academy; e.g., secondary school science teachers, unspecialized professionals concerned with science, and pure amateurs.

I have no idea how many adult amateurs might be at large and susceptible to attraction into the Academy. We know, of course, that there are many nature lovers who go out with field glasses and cameras to sharpen their knowledge and appreciation of birds, trees, flowers, etc. This observational fact finding is the beginning of science. An estimate of the numbers of local amateur naturalists could probably be obtained from the chief naturalist of the National Capital Parks, whose organization exists to help them. At present the Academy has little to offer them, but it could build up services for senior amateurs as effective as those it has already devised for junior amateurs. The way has been pointed out by the Maryland Academy of Sciences, which has set up three affiliated societies for amateurs: (1) archeology, (2) astronomy, and (3) mineralogy. At the meetings of these societies, amateurs can report their observations and show their specimens or equipment, and they can learn from professionals who work with them. The local societies affiliated with the Academy that I happen to know tend to be social organizations of professionals; they do not cater to amateurs.

I was once a professional entomologist, but since World War II I have become an amateur in entomology and a professional servant of biological scientists. As an amateur in entomology, I should like to be a member of a society named, let us say, the L. O. Howard Society, an offshoot of the Academy or of the Entomological Society of Washington, composed of amateur observers, collectors, and photographers of insects. As retiring president of the Entomological Society of Washington, I suggested the encouragement of amateurs by that society, but I now think that the effort had better be made by the Academy as a part of a general program for the encouragement of senior amateurs.

A great proponent of amateur entomology is my first instructor in entomology at Rutgers University, Alvah Peterson. He became professor of entomology at the Ohio State University in 1928, with special responsibility for courses on the bi-

ological control of insects. Because he was there, I was happy to join the faculty of his department in 1936, and I was with him until World War II brought me back to Washington. He was a professional on biological control and a devoted amateur on the identification of immature insects, principally the larvae of insects. As his retirement approached in 1958, he began to study insect eggs, hoping that he could devote full time to them after age 70. The support he applied for was not immediately forthcoming, but he found a temporary job in entomology in Florida and became an amateur on insect eggs. He has also taken every opportunity to promote amateur entomology. Why, he wonders, are birds so much more popular than insects as objects of amateur study in the United States? Is it because all insects are regarded as pests, fit only to be killed? That is not true, of course. Relatively few species do any serious damage to man or his possessions, and relatively little is known about the species that are beneficial or of small economic importance. Whereas an amateur has little chance of contributing anything new to our knowledge of birds, except through banding, he might well add something to our knowledge of insects merely by taking pains to observe closely and frequently populations of any species that he may encounter. The late Austin H. Clark, whom some of you knew, was curator of echinoderms in the Smithsonian Institution. But he was also an enthusiastic amateur entomologist and became an authority on the butterflies of Virginia. He was president of the Washington Academy of Sciences in 1941, a great scientist and ideal amateur whose knowledge and enthusiasm were infectious. What Mr. Clark accomplished, many others can also to a lesser degree.

Dr. Peterson has pointed out that although adult amateur entomology does not thrive in the United States, it does in Japan, where at least one amateur insect society exists in every city. Looking ahead, he wrote, "We might dream of a national amateur insect group comparable to the National Audubon Society . . . . Before this can take place, active, local, adult groups must be established in our cities . . . . Professional entomologists are in a position to help local groups . . ." I hope that Washington will be the first to establish a local, adult, amateur entomological society under the wing of our Academy. The Washington Junior Academy of Sciences also might establish a working group in entomology, or in any other subject of sufficient interest to enlist the attention of a number of students. I use entomology only by way of illustration.

This is the end of my serious message to the Academy. To summarize, I recommend opening membership in the Academy to all adults who are interested in its purposes, and I urge the establishment in the Academy of senior amateur study groups in various branches of natural science.

Academy Receives NSF Grant

The National Science Foundation will grant $26,775 to the Washington Academy of Sciences during fiscal year 1962, for the continuance of the Academy's program on science education. Approval of the grant was announced on April 7 by Harry C. Kelly, associate director of NSF.

The program supported by the grant will have a four-fold objective:

To maintain a roster of scientists and engineers willing to assist with educational activities;

To conduct a series of conferences on problems concerned with science teaching at the local level;

To sponsor and participate in the development of experimental educational courses in science;

To provide for a program of interacademy contacts to improve science educational communications.

As has been the case for previous grants from the Foundation, the program will be administered by the Joint Board on Science Education. John K. Taylor is the Board's director of science projects, while G. Gravatt Coleman is its executive secretary. John W. Carroll operates the project office in the Academy's headquarters at 1530 P St., N.W.

The new program, which will get under way July 1, following termination of the present grant, will continue many of the present activities. The Visiting Scientist Program, which has been so successful this year, will be strengthened. The science teaching conferences will be extended to include discussions of science teaching at the elementary school level. The grant also makes it possible to continue the sponsorship of the experimental courses designed to correlate science and mathematics teaching.

A new feature will provide for an interacademy conference to be held in the late fall. Representatives from neighboring academies will be invited to discuss their respective programs in science education with the aim of coordinating their activities, especially in areas where their boundaries meet or overlap.

In preparation for the continuing program, the Joint Board is revising its roster of scientists and engineers willing to assist in educational activities. The present list includes more than 200 persons who have prepared illustrated and demonstration lectures for presentation to school classes, science clubs, and related groups. Most of them have been called upon at least once, and many have lectured several times during the past year. The list needs to be expanded—new subjects are needed to expand the scope of the list, and additional speakers for subjects already listed are needed to provide services on a wider basis.

Interested persons may phone the office of the Joint Board (NO 7-3661) to obtain the brochure, "Visiting Scientists," which describes the program more fully.

Special WAS Meeting Draws Crowd

Over 400 people attended a special Academy meeting on April 6, at the Carnegie Institution, to hear a discussion on living with a thermonuclear threat.

The speaker was Herman Kahn of the Rand Corporation, whose topic was, "Thinking about the Unthinkable."

Kahn, with a background of training in physics and applied mathematics, has been a Rand staff member since 1948, devoting his attention to problems of military planning and strategy. He is the author of the controversial book, "On Thermonuclear War."

The implications of thermonuclear warfare are decidedly unpleasant to consider, Kahn admits. But he takes the viewpoint that consideration of these implications and their consequences is highly important in order to avoid such warfare or to survive it, if it does occur. He considers various "alternative national postures" and discusses "tragic but distinguishable post-war states" with the number of our dead ranging by steps from 2 million to 160 million and the time for economic recuperation ranging from 1 year to 100 years. He wonders at which of these states the survivors would envy the dead. He considers the elimination of the "unnecessary dead" as something "vastly worth doing." He differentiates between capacity for a limited war (lasting one day) or for a long war (lasting 2 to 30 days). "While thermonuclear war would probably be an unprecedented catastrophe for the defender, this is a far cry from an unlimited catastrophe. The limits of the catastrophe depend on the

kinds of preparations and on how the war is started and fought."

From informal polls of the lay public, the lecturer concludes that the average American might be willing to see this country suffer from 10 to 60 million deaths if necessary in order to maintain our present way of life.

The discussion did not lead to any specific outline for action on either a national or an individual scale. It implied that radiation meters should be made available to every individual.

The lecturer took spirited issue with critics of his book, who feel that considerations of this sort are too horrible to contemplate. In the present state of the world, he insists they are absolutely necessary for survival. In the longer run, if we do survive, he feels that disarmament and world government are the only real solutions to the problem.

MAY MEETING

(458th Regular Meeting of the Washington Academy of Sciences)

SUBJECT

Four-member Panel Discussion:
"Are Science Fairs Hindering Science Education?"

PANELISTS

Keith C. Johnson, D.C. Public Schools
Doris E. Hadary, Bethesda-Chevy Chase High School
Leo Schubert, American University
Burrell Wood, Science Service

MODERATOR

Philip H. Abelson, Geophysical Laboratory

DATE

Thursday, May 18, 1961, 8:15 p.m.

PLACE

John Wesley Powell Auditorium, Cosmos Club, 2170 Florida Ave., N.W.

Science in Washington

SCIENTISTS IN THE NEWS

This column presents brief items concerning the activities of members of the Academy. Such items may include notices of talks given, important conferences or visits, promotions, awards, election to membership or office in scientific and technical societies, appointment to technical committees, civic activities, and marriages, births, and other family news. Formal contributors have been assigned for the systematic collection of news at institutions employing considerable numbers of Academy members (see list on masthead). However, for the bulk of the membership, we must rely on individuals to send us news concerning themselves and their friends. Contributions may be addressed to Harold T. Cook, Associate Editor, care of Agricultural Marketing Service, U. S. Department of Agriculture, Rm. 3917 South Bldg., Washington 25, D. C.

CARNEGIE INSTITUTION OF WASHINGTON

Merle A. Tuve, director, Department of Terrestrial Magnetism, is chairman of the new Geophysics Research Board, National Academy of Sciences.

Hatten S. Yoder, Jr., of the Geophysical Laboratory is head of an American panel organized under the Geophysics Research Board to consider studies on earth's mantle.

COAST AND GEODETIC SURVEY

The Board of Geographic Names has approved the name of Roberts Inlet for an inlet in Berkner Island, Weddell Sea, Antarctica, in honor of **Capt. E. B. Roberts** (retired).

D. S. Carder, member of the Board of Directors, Seismological Society of America, presented a paper, co-authored with W. V. Mickey, on "Ground Effects from Underground Explosions" at the annual meeting of the Society in San Diego, Calif.

GEOLOGICAL SURVEY

George W. Morey visited the Lawrence Radiation Laboratory in Livermore, Calif., and the laboratories of the U. S. Geological Survey in Menlo Park, Calif., March 6-9.

Edwin W. Roedder gave a paper before the Geological Society of Washington, March 22, on "Depression of the freezing point in fluid inclusions."

GEORGE WASHINGTON UNIVERSITY

H. George Mandel, professor of pharmacology, recently became secretary-elect of the American Society for Pharmacology and Experimental Therapeutics.

Paul W. Bowman, professor of biology, will be attending the meetings of the American Association for Cancer Research and of the Federation, in Atlantic City.

Mary L. Robbins, Department of Bacteriology, spent a day recently at Far Rockaway High School, New York, as a visiting biologist under the auspices of AIBS, speaking to four separate classes on microbiology, medical science, and career problems and opportunities. In the evening she lectured on "The Biology of Viruses" to students and teachers and to the Rockaway Academy of Science.

HARRIS RESEARCH LABORATORIES

Alfred E. Brown, former vice president, has been elected president of HRL. Dr. Brown remains director of research of the company, which he joined in 1945.

NATIONAL BUREAU OF STANDARDS

The following talks have been given by members of the staff: **F. L. Alt**: "Recent Results in Machine Translation" at Massachusetts Institute of Technology, March 17; **R. G. Bates**: "Medium Effects in Ethanol-Water Solvents" at a Seminar on Special Topics in Physical Chemistry, Duke University, February 28; **L. M. Branscomb**: "Spectra and Electron Affinities of Gaseous Negative Ions" at Yale University, March 2; **H. P. Broida**: "Trapped Radicals"—Sigma Xi, McGill University, February 20, and Physics-Chemistry Colloquium, University of Western Ontario, February 21; **V. R. Deitz**: "The Rate of Physical Absorption at Low Surface Coverage"—American Chemical Society Colloid Division Symposium at St. Louis, in March; **C. Eisenhart**: "To Fit or Not to Fit; That is the Question" at the Statistics Seminar, Yale University, March 20, and Statistics Colloquium, Harvard University, March 22; **H. P. R. Frederikse**: "Properties of Rutile (TiO_2)" at the Department of Physics, Johns Hopkins University, March 9; **M. L. Greenough**: "FOSDIC III, an Electr-Optical Scanner for Processing the 1960 Census Data" at the IRE (Professional Group on Electronic Computers), Washington, on March 1; **L. Marton**: "Some Aspects of Electron Physics" at the Department of Physics, New York University, March 14; **C. M. Herzfeld**: "Nuclear Orientation" at the Physics Department Colloquium, Duke University, March 8; **G. C. Paffenbarger**: "Dimensional Accuracy of Dentures" at the Berks County Dental Society, Reading, Pa., March 6; **E. K. Plyler**: "Vibration-Rotation Bands of N_2O" at Florida State University, March 14; **L. Rhodes**: "Machine Translation" at the Rochester, N. Y., Optical

Society of America meeting, March 21; **L. S. Taylor**: "Radiation Hazards and Common Sense" and "Opportunities for Scientific Work with the U. S. Government" at Harvard University, March 14-15; **C. E. Weir**: "Progress in High Pressure Research and Future Applications" at Annual Engineers, Scientists Day (Sponsored by the D. C. Council of Engineering and Architectural Societies and the Washington Academy of Sciences), February 23; **W. J. Youden**: "Better Answers with Less Work" at the Joint meeting of the Buffalo-Niagara Sections of American Statistical Association and the American Society for Quality Control, Tonowanda, N. Y., February 27; and "Applications of Statistics in Experiments at NBS" at the Johns Hopkins School of Hygiene and Public Health, March 10.

The following talks were presented before the Dental Materials Group, International Association for Dental Research, at Boston on March 23-26: **G. M. Brauer**: "Synthesis of 5-Methyl-2-propoxybenzoic Acid and Its Reaction with Zinc Oxide"; **G. C. Paffenbarger**: "Silico-Phosphate as Cementing Media"; **G. Dickson**: "Some Rheological Properties of Dental Amalgam."

The following talks were presented before the Fourth Symposium on Temperature, sponsored by the American Institute of Physics, Instrument Society of America, and the National Bureau of Standards at Columbus, Ohio, March 27-30: **H. J. Kostkowski**: "Some Equilibrium and Non-Equilibrium Characteristics of a Helium Plasma Arc" and "Theory and Methods of Optical Pyrometry"; and **A. G. McNish**: "The Role of Temperature in Our Measurement System."

Ernest Ambler, Cryogenic Physics Section, Heat Division, was one of the recipients of the Arthur S. Flemming Award for outstanding men in the Washington area. The award was presented by the Junior Chamber of Commerce of Washington on February 16.

Charlotte M. Sitterly, Spectroscopy Section, Atomic Physics Division, was one of the six recipients of the Federal Woman's Award for her outstanding contributions to the Federal Government in the field of astrophysics and spectroscopy. The award was presented to Dr. Sitterly by the Civil Service Commission on February 24. The award, the first of its kind, was established exclusively to honor career women chosen from the entire Federal Government.

The Exceptional Service Gold Medal Award has been given to **Lewis Branscomb**, chief of the Atomic Physics Division, for his very effective leadership and outstanding scientific contributions in the development of basic knowledge of the atomic processes of stellar atmospheres, the terrestrial ionosphere, and interplanetary space; to **Thomas Digges**, chief of the Thermal Metallurgy Section, Metallurgy Division, for exceptional contributions to the science of metallurgy through his own research on a variety of metallurgical phenomena and through the organization and leadership of highly significant scientific programs at the managerial level; and to **Irl C. Schoonover**, associate director of the Bureau, for exceptional leadership of significance to the Department and the Nation on materials research, program and organization planning, and development and utilization of scientists; and for extraordinary versatility as a scientist-executive.

The Meritorious Service Silver Medal has been awarded to **Martin Greenspan**, physicist in the Sound Section, Mechanics division, for the development of an instrument which measures accurately and rapidly the speed of sound in natural waters, and which greatly facilitates research into the physics of sound in the sea; and to **John Torgesen**, physicist in the Pure Substances Section, Analytical and Inorganic Chemistry Division, for his studies of the growth of single crystals and mechanisms of purification.

S. L. Madorsky of the Polymer Structure Section, Organic and Fibrous Materials Division, retired at the end of February. A tea in his honor was held on February 28 in the Manse Lecture Room.

SMITHSONIAN INSTITUTION

Herbert Friedmann, who was head curator of zoology at the National Museum until his retirement on March 15, became director of the Los Angeles County Museum on April 1.

USDA, WASHINGTON

Hazel K. Stiebeling participated in meetings of the Joint FAO/WHO Advisory Committee on Nutrition, held in Geneva, Switzerland, April 18-25. She also will attend a meeting of the joint FAO/WHO Committee on Calcium, to be held in Rome, May 23-30.

Edward H. Graham, director of plant technology, Soil Conservation Service, is president of the International Commission on Ecology, which will hold its Sixth Meeting at Zurich, Switzerland, May 1-6. Two days will be devoted to business matters, followed by a Symposium on Coordination of Scientific Methods Used for the Study of Ecology in Holarctic National Parks. A field trip will conclude the sessions. The Commission is an integral part of the International Union for Conservation of Nature and Natural Resources, and has served since its origin in 1954 as the scientific advisory body to the Union.

Kenneth W. Parker gave an illustrated talk on "Grasslands in Spain and France," at the March 1 meeting of the National Capital Section,

American Society of Range Management, which was held in the Department of Agriculture.

Kenneth A. Haines, Agricultural Research Service, attended the Sixth Session of the Technical Advisory Council, Inter-American Institute of Agricultural Sciences, held at San Jose, Costa Rica, March 6-10; he served as the United States representative on the Council. The Institute is an arm of the Organization of American States and has as its objectives graduate training and research in the field of agriculture.

USDA, BELTSVILLE

C. H. Hoffmann, Entomology Research Division, ARS, presented a paper entitled "Benefits and Limitations of Insecticides Used to Control Insects of Importance to Agriculture and Public Health" at the 7th Annual Conference of the Illinois Mosquito Control Association, held at Urbana, Ill., March 10.

Erwin L. LeClerg presented a series of 10 lectures on experimental design and applied statistics to a group of 20 entomologists at Vincennes, Ind., in early February, and to 25 research scientists at Belle Glade, Fla., in March. Both groups were employees of the Agricultural Research Service.

At the awards dinner of the National Grain Sorghum Research Committee at Amarillo, Tex., on March 7, the Grain Sorghum Producers Association presented **John H. Martin** with a "Plaque and a Scroll" for distinguished service to American agriculture in sorghum agronomy and physiology.

S. L. Emsweller was awarded a Certificate of Merit in February by the Michigan State Florists Association "in recognition and appreciation of his unselfish labor and achievement for the advancement of the floricultural industry."

Myron S. Anderson attended a meeting of the Iowa Academy of Science at Indianola, April 14-15, and spoke on the subject, "Soil Science as a Cultural Subject." While in Iowa, Dr. Anderson expected to present a short course on geology at William Penn College, Oskaloosa.

Aurel O. Foster has been appointed director of the USDA Parasitological Research Laboratories at Beltsville. In his new position, Dr. Foster will direct and coordinate USDA research programs in animal parasitology.

Kermit W. Kreitlow, research pathologist in the Crops Research Division, presented an invitational paper, "Diseases of Range Forage Plants and Their Effect on Range Management" at the annual meeting of the American Society of Range Management, held in Salt Lake City January 31 - February 3.

W. B. Ennis, Jr., chief of the Crops Protection Research Branch, Crops Research Division, ARS, presented an invitational paper entitled "Progress and Potential in Weed Investigations" at the 14th Annual Meeting of the Southern Weed Conference, St. Petersburg, Fla., January 18-20.

UNCLASSIFIED

Irving A. Denison, a senior chemist on the staff of the Army's Diamond Ordnance Fuze Laboratories, retired on March 17 after more than 40 years of Federal service. He received the A.B. and M.S. degrees from the University of Illinois in 1920 and 1921, and the Ph.D. degree from George Washington University in 1929. He was appointed as chemist in the Department of Agriculture in 1922, and transferred to the National Bureau of Standards in 1929. In 1953, Dr. Denison transferred to the Diamond Ordnance Fuze Laboratories. He is well known for his research on corrosion of metals, and on fuel cells and other unique power supplies.

RETIREMENTS IN 1960

Harvey Chaplin, W. B. Emerson, John C. Lilly, Marvin Marcus, and Benjamin Schwartz.

DEATHS

Walter E. Dove, who would have been 67 years old on April 14, died on March 22. Dr. Dove was a native of Mississippi. He received the B.S. degree from Mississippi Agricultural and Mechanical College in 1913 and the Sc.D. degree from Johns Hopkins University in 1929. He was an entomologist in USDA's Bureau of Entomology from 1913 to 1945, except for about two years when he was in military service during World War I. He was research entomologist with U. S. Industrial Chemicals, Inc., from 1945 to 1954 and entomologist and parasitologist with Food Machinery and Chemicals Corporation from 1954 to 1959. Since 1959 he had been a consultant on insecticides. Dr. Dove was awarded a silver medal by the American Medical Association and received a citation from the Navy Department in recognition of his research on insects affecting man and animals.

Russell S. McBride died on April 3; he was 73 years old. A native of Minnesota, Mr. McBride received the B.S. degree from the University of Minnesota in 1908 and the M.S. degree from the University of Wisconsin in 1909. After working on the chemistry of fuels and gas at the National Bureau of Standards for 10 years, he became engineering representative for McGraw-Hill Publishing Company, and in 1921 became a consulting engineer. He continued this work for 40 years, numbering among his clients the Union Carbide Company, Olin Mathieson Chemical Corporation, the Coca Cola Company, and the Texas Power and Light Company. He was a former president of the Chemical Engineers Club of Washington and the Chemical Society of Washington.

AFFILIATED SOCIETIES

Where information as to the specific program scheduled for meetings of Affiliated Societies was not available sufficiently in advance to have been included in the Calendar of Events for the April issue of the Journal, *it is carried below as a news item. Additional items considered of general interest are noted at appropriate points.*

Acoustical Society of America, Washington Chapter

The final technical meeting of the year, April 17, featured a talk by Vincent Salmon of Stanford Research Institute, on "Factors Affecting the Reproduction of Sound." This gathering was held in the exhibit room of the Industrial Building, NBS, following an informal dinner at the Cafe Burgundy.

The May meeting will be a social gathering. This year, election of new officers will be conducted by mail ballot.

A recent survey of member interests produced lists of 20 and 30 persons, respectively, interested in participating in the Science Teacher Substitute Program and in Science Fair judging. These lists have been passed along to the Joint Board, accompanying a donation toward the financing of the Board. The Chapter contemplates making a certificate and gift award in its area to a local Science Fair winner.

American Institute of Electrical Engineers, Washington Section

"The Polaris Submarine" was described by Cmdr. G. F. Moran at the April 11 meeting, attended by local members and by members of the National Marine Transportation Committee of the national organization, then meeting in Washington.

Election of officers for the coming year took place at the April general meeting.

Two technical discussion groups met in April: on the 4th the Division on Communications heard William Keister, Bell Telephone Laboratories, speak on "Progress in Electronic Switching—a System Trial at Morris, Ill."; and on the 18th the Power Division discussed "System Planning for Small Utilities and Large Industrial Plants."

American Society of Civil Engineers, National Capital Section

The Section met on March 28 as host to the Washington Section of the Institute of Traffic Engineers. At this time, Francis C. Turner, Bureau of Public Roads, presented a current and comprehensive view of the "National Highway Program," described as the "greatest public works undertaking of all time."

Col. J. H. Kerkering, Army Engineer Research and Development Laboratories, spoke to the group on April 6, at Ft. Belvoir, on "Camp Century — City Under Ice."

American Society of Mechanical Engineers, Washington Section

Milton Slawsky, Air Force Office of Scientific Research, on April 13 discussed "Plasma Acceleration" and problems involved in applying these concepts to a propulsion system, based on current research and development.

New officers, elected at the last meeting in March, are Virgil L. Pence, chairman, John A. Cannon, vice-chairman, Robert O. Belsheim, secretary, and John W. Abouchar, treasurer.

Botanical Society of Washington

Members of the Society met on April 4, at 5:30 p.m. for a tour of the National Arboretum, followed by a picnic supper, and a discussion by Director Skinner and his staff of the facilities and research program of the arboretum.

The final meeting, in May, will be the annual banquet.

Chemical Society of Washington

A general meeting of the Society was held on April 13 at the National Museum. Linus Pauling, of California Institute of Technology, spoke on "The Structure of Electron-Deficient Substances."

Entomological Society of Washington

Two papers comprised the Society program on April 6. The first, by Maj. R. M. Altman, Walter Reed Army Institute of Research, concerned "The Army Program of Insect Control in Panama," and the second, by A. M. Heimpel of USDA, dealt with "Use of Microorganisms in the Control of Forest Insects."

Geological Society of Washington

Officers for 1961 are: President—C. Arthur Cooper; vice presidents—Harold M. Bannerman and Charles L. McGuinness; treasurer—Margaret Cooper; secretaries—Frank C. Whitmore, Jr., and John T. Hack.

The 822nd meeting of the Society, April 12, heard papers by T. P. Thayer, Geological Survey, on "Some Glimpses of the World Chromite Situation, Economic and Otherwise"; Catherine W. Skinner, NIH, on "Precipitation of Dolomite in South Australia"; and Philip H. Abelson and Thomas C. Hoering, Carnegie Institute, on "Fractionation of Carbon Isotopes by Living Matter."

Helminthological Society of Washington

On April 21, the following program was presented to the Society at the Johns Hopkins University School of Hygiene and Public Health, Baltimore:

"Rous Sarcoma in the Embryonated Egg with Special Reference to Endothelium," by Helen V. Coates; "Studies in Pathogenicity of *Eimeria acervulina* in Chickens," by Stuart M. Krassner; and "Population Density Influence on Changes in the Chemical Composition of *Hymenolepis diminuta* During its Growth in the Definitive Host," by Larry S. Roberts. Four additional contributions were grouped under the general head-

ing, "Introduction to the Laboratory of Parasite Biochemistry."

Insecticide Society of Washington

"Nucleic Acid," was discussed by Norman Mitlin, USDA, on April 19 before the Society, accompanying a paper by J. R. Foster, University of Maryland, on "Maryland Mosquito Control Program."

Institute of Radio Engineers, Washington Section

What is described as an "outstanding advance" and an "amazing device," the Optical Maser, was discussed before the Section on April 10 by Donald F. Nelson of the Bell Telephone Laboratories. Apparently, this instrument is capable of producing a coherent, parallel beam of great intensity. Some of the scientific and technological uses of the ruby optical maser were demonstrated.

The Professional Group on Microwave Theory and Technics, meeting on April 11, heard C. T. McCoy of the Philco Corporation, speak on "Spectrum Utility in Space Communication."

Medical Society of the District of Columbia

In addition to its customary lengthy roster of medical events for the month, we received an early notice of a hobby show, or Doctors Hobby Exhibit, to be a feature of the 29th Annual Scientific Assembly, Statler-Hilton Hotel, on November 27-29 of this year. Apparently any hobby, provided it lends itself to exhibiting, is eligible and provision made for safekeeping overnight of valuable items.

We note, too, solicitation from members of nominations for the John Benjamin Nichols Award to a lay person or organization, or both, in recognition of unusual enterprise or service in the interest of better health for the people of the District. The award, a bronze plaque, must be to a recipient whose income is not derived from activity in the health field; it was established eight years ago by the Executive Board of the Society.

Philosophical Society of Washington

"Coesite and Craters" was the title of a talk by E. C. T. Chao, Geological Survey, on April 14.

Society for Experimental Biology and Medicine, District of Columbia Section

A series of four papers made up the March 30 program, each scheduled for 15 minutes:

"Carcinogenesis in the Newborn," Roger O'Gara, NIH; "Biochemical Studies of the Chick Edema Disease," D. F. Flick and Linda Gallo, FDA; "The Effect of Neo-Natal Cross Deimmunization on Tumor Transplant Susceptibility in Mice," J. M. Bailey and Keith Merrill, GWU; and "Transfer of Iron from Synthetic Iron-Binding Chelates to Rabbit Reticulocytes." G. Shashaty, E. J. Zapolski, M. Rubin, and J. V. Princiotto, GU.

Society of American Bacteriologists, Washington Branch

The annual meetings of the parent organization, held in Chicago April 23-27, made it advisable to cancel the Branch meeting for that month.

Society of American Foresters, Washington Section

On March 16, H. A. Fowells gave an illustrated lecture on his recent trip around the world, under the title "Jet's Eye View of Forestry Around the World." The April field trip will be the last meeting of the Section until next fall.

Washington Society of Engineers

The last meeting of the Society, on April 19, featured A. G. McNish of NBS in a talk on "Our System for Standards of Measurement," showing the trend to use of physical constants for this purpose.

It is expected that the biannual Roster will be completed and mailed very shortly.

CALENDAR OF EVENTS

Events which will take place, so far as we can determine at the time of writing, subsequent to the appearance of the Journal *are noted below. Where possible, the nature of the program is indicated; in many instances the entry merely notes date and place of a regularly-scheduled meeting of the organization named. Last-minute changes in time and place, or emergency cancellations, may in certain instances alter the situation. At this time of year, too, certain local groups suspend formal meeting activities for the summer months.*

May 8—Institute of Radio Engineers, Washington Section

Museum of Natural History, 8:00 p.m.

May 9—American Institute of Electrical Engineers, Washington Section

PEPCO Auditorium, 8:00 p.m.

May 9—American Society of Civil Engineers, National Capital Section

John Wesley Powell Auditorium, 8:00 p.m. Presentation of slate of candidates for office.

May 10—American Society for Metals, Washington Chapter

National Officers Night. W. A. Pennington, national president, will speak on "Diffusion and Transport of Carbon in Ferrous Alloys."

AAUW Headquarters, 2401 Virginia Ave., N.W., 8:00 p.m. Dinner, 6:30 p.m.

May 10—Geological Society of Washington

John Wesley Powell Auditorium, 8:00 p.m.

May 10—Institute of Radio Engineers, Washington Section

Meeting of Professional Group on Electron Devices.

May 11—Chemical Society of Washington

Annual "meeting-in-miniature."

University of Maryland. Dinner in University Dining Hall, 6:30 p.m. ($2.75). Divisional sessions in Nathan L. Drake Lecture Hall of Chemistry, 8:15 p.m.

May 11—American Society of Mechanical Engineers, Washington Section

PEPCO Auditorium, 8:00 p.m.

May 12—Philosophical Society of Washington

John Wesley Powell Auditorium, 8:15 p.m.

May 15—Society of American Military Engineers, Washington Post

Regular meeting combined with the annual meeting of the National Society of American Military Engineers.

May 16—Anthropological Society of Washington

Business meeting of the Society.

Room 43, U. S. National Museum, 8:15 p.m.

May 16—Institute of the Aeronautical Sciences, Washington Section

Thomas Finch, Flight Test Center, NASA, "The X-15, A Vehicle for Advanced Research."

Occidental Restaurant. Dinner, 6:00 p.m.; meeting, 8:00 p.m.

May 15-17—Institute of Radio Engineers, Washington Section

Professional Group on Microwave Theory and Technics National Symposium, Sheraton-Park Hotel.

May 16—Institute of Radio Engineers, Washington Section

Professional Group on Space Electronics and Telemetry.

May 17—Insecticide Society of Washington

L. D. Christenson, "Tropical Fruit Fly Population-Sterilization Research in Mexico, Hawaii, and the Western Pacific"; and E. F. Knipling, "Comments on Possibilities of Applying the Sterile Male Principle to the Control of Other Insects."

Symons Hall, University of Maryland, 8:00 p.m.

May 18—Institute of Radio Engineers, Washington Section

Professional Group on Antennas and Propagation.

May 22—Institute of Radio Engineers, Washington Section

Professional Group on Broadcasting. Elton Davis, FCC, "Automation of Directional Antenna Computation by FCC."

May 23—American Society of Civil Engineers, National Capital Section

Luncheon meeting.

YWCA, 12:00 noon.

May 23—Anthropological Society of Washington

Margaret Mead, American Museum of Natural History, "Theory and Methodology in the Study of Human Behavior."

Room 43, U. S. National Museum, 8:15 p.m.

May 23—Society of American Bacteriologists, Washington Branch

G. P. Gladstone, Oxford University and NIH, "Staphylococcal Leucocidins."

Sternberg Auditorium, Walter Reed, 8:00 p.m.

May 24—Geological Society of Washington

John Wesley Powell Auditorium, 8:00 p.m.

May 24—Institute of Radio Engineers, Washington Section

Professional Group on Engineering Writing and Speech, joint meeting with Society of Technical Writers and Publishers.

May 25—American Society of Mechanical Engineers, Washington Section

Meeting in area of product engineering.

PEPCO Auditorium, 8:00 p.m.

May 26—Philosophical Society of Washington

John Wesley Powell Auditorium, 8:15 p.m.

The following meetings, scheduled for June, have come to our attention:

June 1—American Society of Mechanical Engineers, Washington Section

Fuels symposium.

June 1—Society for Experimental Biology and Medicine, District of Columbia Section

Annual dinner meeting.

June 12-13—Institute of Radio Engineers, Washington Section

Third National Symposium on RFI.

June 26-28—Institute of Radio Engineers, Washington Section

Fifth National Symposium on Military Communications.

ACADEMY ACTIVITIES

APRIL BOARD MEETING

The Board of Managers held its 537th meeting on April 4 at the National Academy of Sciences, with President Abelson presiding. The minutes of the 536th meeting were approved with minor corrections.

Dr. Abelson discussed briefly the release of the Academy's full-time employee as of March 31, and its impact on the offices of secretary and treasurer. He indicated that for the time being, the Science Calendar would be maintained in the director's office at the Geophysical Laboratory; and the phone in the Academy office will be answered by Mr. Carroll of the Joint Board on Science Education, until other arrangements can be made. Mr. Detwiler pointed out

that maintenance of the Academy's mailing list was of great concern to the *Journal*; it was agreed that the secretary, treasurer, and editor would meet to set up procedures for handling the mailing list.

For the Meetings Committee, Dr. Abelson announced a special meeting of the Academy had been scheduled for April 6, at which Herman Kahn of the Rand Corporation would speak on "Thinking About the Unthinkable," with related comments by Marquis W. Childs and Frank T. McClure. At the regular meeting on April 20, Father Francis J. Heyden of Georgetown University was scheduled to speak on "Astronomy Looks to its Future."

Dr. Robbins reported that the Membership Committee had been drafting a statement on criteria for membership in the Academy, but that the statement was not yet ready for presentation to the Board. She announced that the Committee's roster of members was practically complete.

Dr. Robbins then presented for first reading the names of ten candidates for membership.

Dr. Campbell reported that the Policy and Planning Committee had met on March 30, and had discussed several topics, including (1) a recent recommendation by a science committee of the U. S. Chamber of Commerce, that basic and applied research in Government be abandoned; (2) Dr. Abelson's suggestion that the Board of Managers and the Joint Board on Science Education might foster the indoctrination of secondary-school students in the detection and estimation of radiation hazards, through training in the use of radiation monitoring devices; and (3) the encouragement of interest on the part of the Columbia Historical Society in the history of science in the Washington area. Recommendations concerning the first two topics may be brought before the Board at a subsequent meeting. Concerning the third topic, Dr. McPherson has volunteered to pursue the matter with the Columbia Historical Society.

Dr. Campbell suggested that the Academy should have a liaison with the Washington Board of Trade, specifically to get acquainted with the plans and planners of the National Cultural Center.

In the absence of Dr. Brenner of the Committee on Encouragement of Science Talent, the secretary read Dr. Brenner's report on the dinner held March 16 for superior science students and their teachers, and his recommendations for conduct of next year's dinner.

Following the second reading of their names, the following persons were elected to membership in the Academy: Mattie R. Fox, Albert L. Ryall, and Romald E. Bowles.

Dr. Campbell presented an extensive report on the organization and operations of the New York Academy of Sciences.

SCIENCE AND DEVELOPMENT

Eleven young scientists are now conducting advanced basic studies at the National Bureau of Standards under the Postdoctoral Resident Research Associate program. This program is sponsored jointly by the National Academy of Sciences — National Research Council and the Bureau; it is now in its seventh year. The plan provides advanced training in research for creative young scientists who have shown promise of leadership in fundamental research. Besides training, the program provides for a "cross-fertilization" of ideas, bringing the benefits of the scientist's new approaches and the results of his research to the organizations at which the research is performed and at which the scientist ultimately associates on a permanent basis. Research associateships have been awarded to 44 young men in the six years the plan has been in effect at NBS. Fourteen of the first 31 applied and were accepted as permanent members of the staff. The Naval Research Laboratory has a similar program.

According to F. W. Reichelderfer, chief of the Weather Bureau, a new weather exchange linking the United States and Japan as part of an improved weather communications network was scheduled to begin operation on March 1. Installation of the point-to-point radio teletypewriter circuit between Tokyo and Honolulu will complete the Northern Hemisphere Exchange Program started October 1, 1960. Five Northern Hemisphere Exchange Centers located at New York, Frankfurt, Moscow, New Delhi, and Tokyo, and connected by landline and radio teletypewriter make it possible to receive weather data from the entire Northern Hemisphere at any regularly designated dissemination points. The next phase of the program will be the establishment of a similar network in the Southern Hemisphere, connected with the Northern Hemisphere network. Organization of this system is the result of several years of coordination and planning by members of the World Meteorological Organization and Agency of the United Nations.

A National Oceanographic Data Center was established January 16 with administrative headquarters at the U. S. Hydrographic Office. It is sponsored jointly by the Department of the Navy, Department of Commerce, Department of Interior, Atomic Energy Commission, and the National Science Foundation. It will serve as a repository for data on the physics, chemistry, biology, geology and meteorology of the oceans. It will prepare and publish indexes, summaries, and tabulations showing annual and seasonal oceanographic conditions, and promote the routine collection of ocean-wide survey data.